This Bulletin is an official publication of the extension service of the Bureau of Sugar Experiment Stations, issued and forwarded by the Bureau to all cane growers in Queensland.

The Cane Growers' Quarterly Bulletin

VOL. XVII. 1 JULY, 1953 No. 1

Control of the Common Reed in the Moreton District

By N. McD. Smith

In the Moreton area much of the highly productive cane-land is low-lying and requires extensive drainage. In such an environment the common reed (*Phragmites communis*) flourishes and it has become a major pest in both the cultivation and the drainage systems. It is a serious competitor of the young cane and later, the brittle, pointed ends of broken stalks and the sharp-edged leaves can cause severe cuts to those working or handling the cane.

Cultural Methods of Control.

Improved drainage and variations in cultural methods have been used in attempts to control the pest. Better drainage aims at producing a habitat unnatural for the reed and also allows deeper tyne cultivations over a longer period.

During winter, deep cultivation results in the thinning out of the reed stand as the rhizomes are brought to the surface and dry out. Unfortunately this operation can only be performed one year in about five for it must be done when the land is not under crop.

For the control of reeds in a standing crop, hand chipping is the most effective practice. The use of cultivators merely bruises the stems and has little effect on growth. Deep, tyne, inter-row cultivation does give some control of the reed, but there are practical difficulties with the shallow, clay subsoils so characteristic of the Moreton reed-infested lands.

An important point in the hand chipping of reeds is the necessity to sever the reed stalk slightly *above* ground level. This stimulates the topmost eyes of the stubble so giving rise to a cluster of sickly shoots which cannot compete with the young canes. Should the stalk be cut below the ground a strong, vigorous sucker will arise to constitute as big a nuisance as its forebear.

Mowing or scything of thickly infested patches in a field is sometimes carried out before harvest to enable a hotter fire and to lessen inconvenience to the cane cutters. Close pasturing of horses on the infested area effects a reasonable control but is impracticable under normal farming conditions, since the area must be kept bare for at least two years. Moreover, even with this method the stand will never be completely eradicated.

Chemical Control.

Experiments conducted with power kerosene, arsenicals, chlorate - type

weedicides and sodium tri-chloroacetate were not successful, since although the foliage and stalks were burnt, sucker growth became stimulated and in a very short time the position was as bad as ever. However, the application of hormone-type weedicides such as 2,4-D, alone, or in combination with 2,4,5-T, gave much more promising results. Trouble was experienced in early trials with coverage of the reed foliage and a detergent had to be used as a means of spreading the spray and facilitating absorption into the plant.

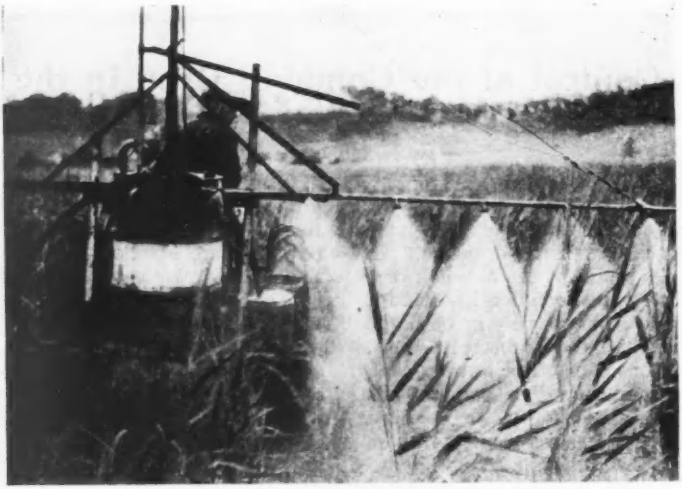


Fig. 1—Boom spray operating in a reed-infested field of cane. It is sometimes difficult to wet the stiff, upright reeds thoroughly.

Of the two weedicides used, the combined 2,4-D/2,4,5-T formulation was superior, giving a complete kill of treated stalks and suckers within six weeks of a single spraying. Growth conditions for reeds at the time were excellent as rainfall was above normal for the period and this is important in view of later trials conducted under drought conditions.

The concentration of spray, using a knapsack with twin nozzles was two fluid ounces of a 2,4-D/2,4,5-T commercial formulation (2,4,5-trichlorophenoxyacetic acid 20 per cent. butyl ester and 2,4-dichlorophenoxyacetic acid 20 per cent. ethyl ester) plus detergent ("Lissapol" N.300, 1 : 700) to one gallon of water. Satisfactory coverage of a moderate stand could be obtained with about 100 gallons of spray per acre.

The weedicide caused browning of wetted foliage within 48 hours and complete death, with subsequent dropping of leaves, in about four to six weeks. On occasions the stalk snapped off approximately half-way up within the four week period. This peculiarity could be anticipated by attempting to bend the stalks two or three days after spraying. A normal stalk would then bend to 45°, but a sprayed one would snap at about 20° from the upright.

The effect of the weedicide on the rhizomes appeared to depend on growth conditions. When conditions were good there was a definite check to the first eye below the junction of the sprayed stalk and its parent rhizome. On the other hand, if growth were slow there was a development of the top two or three eyes which was similar to (but slower than) the suckering which would occur if the stalk had been cut off. Brushing of stalks to within six inches

of the ground and spraying of the stubble did not have any effect on subsequent growth of suckers.

In the initial trials it was of interest to note that neither the headland grasses nor the sugar cane were adversely affected by spray at the concentration used, even though their leaves were well wetted when spraying the reed foliage.

The success obtained from knapsack trials led to further trials using a powered boom spray. In this experiment the aim was to spray the row only and by controlling the reed in young cane to give it sufficient time to overcome competition. Unfortunately drought conditions prevailed and control of the reed was much slower and not as effective as previously.

A big problem was the thorough wetting of the stiff, upright reed leaves and stalks. As the boom passed overhead (Fig. 1) the stalks would bend and then spring back too quickly through the spray zone to be wetted satisfactorily. To overcome the difficulty, a series of light poles (Fig. 2) was attached ladder-fashion to the boom, and these kept the foliage bent long enough to allow a good coverage. This method can only be used in very young cane for, as the cane foliage becomes denser, it is found that the reed leaves are often protected and do not receive the requisite dosage of spray.

Power spraying under field conditions was not as successful as the knapsack method of earlier trials. However, the influence of the drought which prevailed during the trial must be taken into account since it may have led to a less rapid transference of hormones to the vital tissues of the plant. Nevertheless, the results obtained on nine different occasions with the power spray indicate that an effective control by this method is possible. Where thorough wetting had been effected, the stalk died as was expected, but it is important to allow about two days to elapse before cultivating the field to avoid damaging the stalks and thus interrupting transfer of the chemical through the plant system. When dry conditions prevail it is considered wise to leave the sprayed stalks untouched for as long as possible.

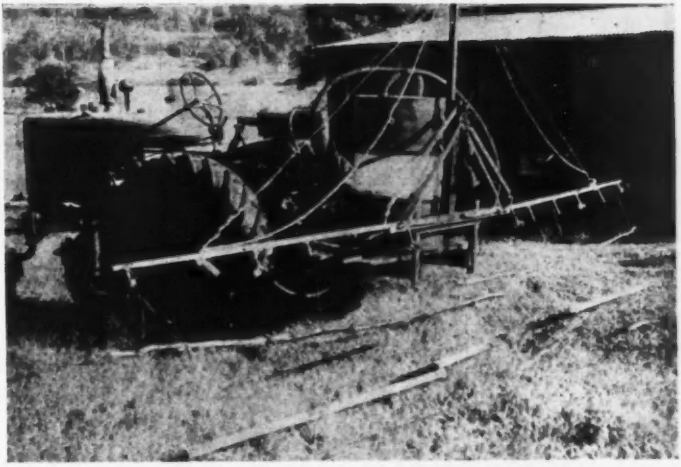


Fig. 2—A series of light poles drawn behind the boom keeps the reed foliage bent over long enough to allow the spray to wet the plants thoroughly.

Recommended Application.

The concentration of spray should be watched carefully; for instance, a twin-

nozzle knapsack spray will give adequate cover at about 100 gallons per acre, and the amount of chemical required is two fluid ounces of the previously mentioned 2,4-D/2,4,5-T mixture to one gallon of water. In the case of a power spray delivering 50 gallons per acre the dosage of chemical and detergent per gallon of water should be doubled. In other words, the amount of hormone and spreader applied per acre should be maintained at a uniform rate. It has been found from power-spray trials that a volume per acre of not less than 60 gallons is required to obtain the desired coverage. In this respect great

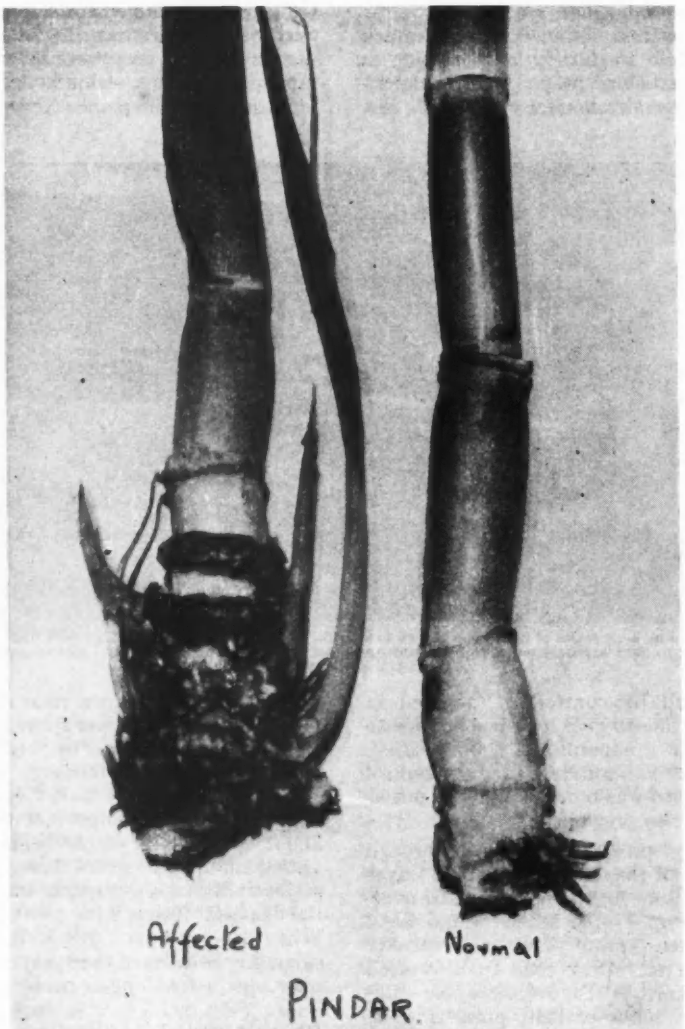


Fig. 3—Damage to cane will occur if excessively strong concentrations of weedicide are used. The abnormal growth of the affected stalk on the left should be compared with the unsprayed stalk on the right.

assistance is given by a heavy dew and a still atmosphere and, for these reasons, it is recommended that sprayings be made in the early mornings.

Warning.

It is necessary to point out that, when applied to reeds in standing cane, the spray concentration must not be greater than the recommended dosage, since damage to cane foliage and stalks will follow if an excess of weedicide is used. As has been stated, the weedicide selected as most efficient was a 2,4-D/2,4,5-T commercial formulation at the rate of two fluid ounces (plus detergent) to one gallon of water at a volume of 100 gallons per acre. An increase of one fluid ounce of weedicide per gallon of water in the knapsack spray was found to burn foliage slightly and cause malformation and depression of the growth of the cane.

A spray consisting only of straight 2,4-D (98 per cent. as sodium salt) plus detergent, was also tried but, under the conditions of the tests, this did not give a kill of reeds unless a strength of one and one-third ounces to one gallon of water at a volume of 100 gallons per acre was used. At this concentration damage to the cane was severe and, apart from stem abnormalities (Fig 3), leaves were partially burnt. There was also a depression of vigour sufficient to cause an estimated loss of 10 tons per acre.

From observations there appear to be two main factors which determine extent of damage when cane foliage is sprayed with hormone weedicides at a strength slightly above that required to kill reeds. These are:—

(1) A stool with formed stalks is more liable to damage than very young cane.

(2) A variety open in habit with stiffish leaves (*e.g.*, Pindar), allows easier penetration of spray to the root-band region of the stalk than does a cane having a denser, more drooping foliage (*e.g.*, N.Co.310).

Cane-Killing Weed in the Mackay District

By C. L. TOOHEY

During January and February, 1953, several reports were received regarding the cane-killing weed on a number of different farms in the Mackay district. In these instances damage ranged from a slight to an extreme stunting and death of stools, depending on whether the weed was detected at an early stage or whether it was well established before discovery. Although generally recognised as a pest of "new" land, on which it has been frequently reported, cane-killing weed has lately proved troublesome on land which has been under cultivation for a number of years at Mirani and Carmila West.

The cane-killing weed belongs botanically to a genus of plants called *Striga*, the various species of which comprise a small group of flowering weeds which are parasitic on other plants. Several species of *Striga* occur fairly commonly throughout the tropics, and the name "cane-killing weed" is a general term applied to those species which are found parasitic upon the roots of sugar cane in Queensland. At least three types have been recorded in Queensland: they differ chiefly in the colour of the flowers, which may be light blue, lilac or pink, and in the erect or trailing habit of the plants. *Striga* was first recorded in the Mackay district at Carmila in 1924, and following is a description of the type found there:—

The weeds are mostly found close to the base of the cane stools, but frequently they occur in the interspaces. They vary in height from nine inches to two feet. The stems are green, round at the base, but they become square higher up. The leaves,

though small, are long, narrow and green. Near the base of the stem the leaves are set opposite each other, but these are arranged alternately as the stems lengthen. Both leaves and stem are covered with small spines which make the plant rough to the touch. Flowers are small and pink. The plants for a considerable distance, while neighbouring rows are apparently unaffected. In young cane, affected stools are stunted with short, stiff leaves; in more advanced cane the stools are even more markedly affected with sparse stiff tops and clinging trash which may induce the development of aerial roots.

Fig. 4—A heavy infestation of cane-killing weed in a Mackay canefield.

flower in late summer and the minute seeds mature in late autumn or early winter. They do not germinate until the following spring.

Where the weeds are present in a field of cane in any considerable numbers, the general impression gained is of an irregular patchy occurrence of stunted stools surrounded by healthy cane. In some instances the effect of the weeds will extend along one row

The roots of the cane-killing weed do not feed from the soil, but attach themselves to the cane roots by means of small spherical swellings. By a process of drawing food from the cane roots, combined probably with the release of a poisonous substance back into them, these parasites cause stunting and eventual death of the affected stools. The word " probably " in relation to a poisonous substance is used advisedly.

Although no direct evidence is available to prove this, it is known that cane stools three feet high and growing under ideal conditions can be killed by a small number of these weeds, whose total dry weight would not exceed that of one or two cane leaves.

The cane-killing weed appears during the summer and dies off in autumn. When dying it turns from green to bluish-black and is not always easy to locate among the stools. The weed is an

Fig. 5—Plants of the cane-killing weed amongst stunted cane at Mackay; weed-free cane in the background.

annual and is dependent upon seed for propagation. These seeds are light and easily carried by drainage or irrigation water—a fact which would serve to explain the appearance of the weed on land which has been under cultivation for long periods since normal cultivation would tend to destroy it.

Control.

Excellent control of this pest has been achieved in the Mackay district by spraying the weed with 2,4-D at the rate of 1lb. to 40 gallons of water. When the weed was sprayed in the early stages of growth, the cane made a recovery from the effect of the parasite. Careful handling of the spray should make certain that little, if any, damage is done to the cane.

Fallowing of the affected block and sowing to a green manure crop will rid the land of most of the seed. Although seeds of *Striga* will germinate in the presence of the roots of many legumes, it would appear that legumes are not suitable as hosts for the support of this parasite. Some of the young weeds die while others may live as feeble parasites. These are so weak that their shoots seldom emerge above the ground and they never set seed.

With the opening of large areas of new country to cope with increased assignments it is probable that the cane-killing weed will be found more frequently. By carefully examining young cane for this parasite and promptly spraying with 2,4-D at the recommended dilution, severe and costly damage can be avoided.

Should any grower have reason to suspect the presence of cane-killing weed on his farm and yet be in doubt regarding its identification, he should consult officers of the local Sugar Experiment Station or of the Cane Pest and Disease Control Board for further advice.

The Ratoon Stunting Disease Problem*

By NORMAN J. KING

I make no apology for addressing this conference on a subject which I have mentioned on previous occasions; I refer to ratoon stunting disease. The subject is not new to any of you, and it may be thought in some quarters that the Bureau is tending to over-emphasise its seriousness. In this instance over-emphasis is desirable because, in the light of our present knowledge, ratoon stunting disease is the major production problem facing the cane growers of Queensland.

In the past when we have spoken of the incidence of diseases and the losses which they might bring in their wake we were able to point to certain outward symptoms whereby you could readily detect the affected stools. We appreciate that this new disease is in a different class in as much as there are not outward symptoms but merely a loss in yielding power which may not be noticed except in very susceptible varieties. When Q.28 was first affected in Mackay it was shown that 10 to 15 tons per acre were lost in ratoon crops; this serious loss of yield was sufficient to attract attention to the variety, and it was obvious to any observer that some important factor was militating against crop yields. This was proved to be a disease, transmissible by knives and cutter planters. Only last year was it established that certain internal markings in the stalk denoted the presence of the disease.

As soon as these markings were established as denoting the presence of ratoon stunting disease a State-wide survey showed that it was present in every mill area. In no other variety was

*Address to Q.C.G.A. and A.S.P.A. Annual Conferences, March, 1953.

the stunting of ratoons so marked as in Q.28 and it is easy to appreciate that the loss in crop had been overlooked by technical men and farmers alike. In past years if a variety fell off in the ratoon crop it was explained merely as the natural performance of that variety to yield less in ratoon crops than in plant cane. A drop from 30 tons plant to 20 tons ratoon was considered the normal and natural thing. The widespread nature of ratoon stunting disease —and the fact that we do not know how long it has existed in our industry —throws a different light on the yield capacity of our varieties. The question naturally arises " How many tons per acre are we losing as a result of this previously unsuspected disease ?" That query cannot yet be answered.

The severe stunting of ratoons was first noticed in Q.28 in Mackay in 1944-45—a short eight years ago. This new seedling cane had probably contracted the disease from another commercial variety in the Mackay area; the circumstantial evidence leads us to believe that this was the case. As you know, our quarantine regulations are fairly strict and varietal transfers from one district to another are made only after careful inspection of the source of plants and with due regard to the proximity of any disease. It is inconceivable that in those few years ratoon stunting disease could have spread to every area in the State and have become as firmly entrenched as it appears to be to-day. The alternative explanation is that the disease has been present in most, if not all, mill areas for many years and that its effects remained unnoticed until the introduction of a particularly susceptible variety. Since most of our commercial varieties have apparently been somewhat tolerant or possessed a degree of resistance, the losses have not been sufficiently marked to attract more than passing attention. Latterly one of Queensland's principal varieties, Trojan, has been found to be quite susceptible to the disease and the importance of this finding to the northern growers does not need stressing. In 1951 Trojan produced almost 1,100,000 tons of cane. If we calculate that ratoon stunting disease will cause a drop of only one ton per acre—say from 25 to 24 tons—the loss of cane would be 44,000 tons with a value approximating £170,000. But we can show you that the loss is much greater than this. Our officers were called to a farm in a northern mill area last October. A block of Trojan ratoons had been planted originally from two plant sources and when inspected one of these sources was found to be diseased and the other healthy. The ratoon crop showed a difference of 12 tons per acre valued at £48. It is obvious that on a farm which harvests 40 acres of Trojan annually the loss to the grower, if all the cane were diseased, would be £1,920. Losses of similar magnitude can occur in P.O.J.2878, M.1900 Seedling and Q.813.

If we accept that this disease has been present in our fields for a long time some interesting speculations can be made. Growers of long standing in the industry can look back over a procession of cane varieties which in turn attained favour, assumed some prominence and then declined in production. This changing picture was not always the result of a cane being superseded by a superior variety. It was the result—and this was stressed by farmers on countless occasions — of deterioration in yield or so-called " running out " of the variety. In other words, the yield of a cane gradually dropped and it was eventually replaced by a newcomer which retrieved the position and in some cases improved it.

But how does Badila fit into this argument ? It is still a major variety after 57 years of growth in Queensland and in 1951 still produced 815,000 tons of cane.

Older growers claim that Badila has not deteriorated and that it will still produce as good crops as originally if grown on suitable land. Why has it not " run out " in the presence of this disease ? The reason is that Badila is apparently fairly resistant to ratoon stunting disease and this is confirmed

by the scarcity of internal symptoms in fields of this variety.

Our present knowledge of the disease and its effects on our commercial canes have led us to develop the theory that ratoon stunting disease is the basic cause of the "running out" of cane varieties over the years. Such a theory explains many mysteries in our industry. It answers the question why a good variety falls from favour through decreasing yields, since over a period of years it would become progressively more diseased. It explains why promising seedling varieties fall by the wayside after producing so well in their early years on Experiment Stations. It explains why other varieties, the resistant ones, persist in cultivation over long periods.

In considering the distribution and origin of such a disease we were naturally concerned with whether it occurred in other countries. Every year the Bureau imports a number of varieties from other countries and in the absence of well defined symptoms our quarantine arrangements would not be fully effective in detecting any varieties so diseased. During last spring we received three consignments of cane setts from two other countries. Examination of some of the end nodes on the setts disclosed similar internal markings to those which we use for identification of the disease. We have communicated with both of these countries and their pathologists have confirmed that they also are troubled with loss in yielding power of varieties and that similar internal symptoms are present in their failing canes.

On the other hand, the collection of varieties brought in from New Guinea in 1951 has been examined after spending a year in this country and no symptoms were detected.

Sugar-cane agriculturists throughout the world have been puzzled for years regarding deterioration in yield of varieties and the inference to be drawn from the above findings is that the disease which has been identified in Queensland is probably world wide in its incidence. It does not necessarily follow that only one disease is causing the depression in yield; it may be two or three similar affections.

But the matter of most concern to us in this country at the present time is a means of control.

If our industry is suffering losses in crop—and the foregoing evidence more than suggests that it is—the first step is to find means of reducing those losses if not eliminating them altogether.

It is obvious from what I have already said that one means of control is the selection of planting material only from well grown ratoon crops. Any ratoons which have not developed normally should not be used in any circumstances and it is inadvisable to use plant cane unless it has a clean history. Our field advisers or supervisors of Cane Pest and Disease Control Boards can inspect fields for their suitability for planting and can, by cutting into a number of stalks, find whether any internal symptoms of the disease are present. These simple measures will, in themselves, exercise some measure of control.

There is only one sure way, so far as we know at present, to ensure complete freedom from ratoon stunting disease. That is by hot-water treatment of planting material. This is nothing new since we have for years been curing chlorotic streak in sugar-cane setts by immersing them in water at 52° C. for 20 minutes. Ratoon stunting disease, however, is more resistant to heat treatment than is chlorotic streak and it is necessary for adequate control to immerse for two hours at 50° C.

We have given considerable publicity to this treatment. During last year we advocated 53° C. for one hour and, although this is very effective with Q.28, it is now found to be too severe on certain other varieties. By reducing the temperature to 50° C. the damage to buds is eliminated, but the period of treatment has to be doubled. There is ample evidence that the heat treatment cures the disease, and the ratoons grown from hot-water treated plants of Q.28 are about twice as vigorous as those from diseased plants.

It is certainly in the best interests of the industry that a concerted and energetic attempt be made to introduce this control measure into all areas. We have held discussions with various Cane Pest and Disease Control Boards and some have already treated appreciable tonnages of plants to provide a nucleus of clean stocks for their areas. The heat treated stocks will remain clean only so long as they are not reinfected by knives or other implements previously used on diseased cane, but with normal care it is practicable for any grower to clean up his own farm in three or four years. That is what we are doing on our Experiment Stations. Hot-water treatment is not a recommended farm practice; it is one for co-operative effort. Steam is the cheapest method of heating water and the obvious system is for a large tank at a mill to be heated by steam and the bags or baskets of plants to be immersed and taken out by means of a crane. Careful attention to temperature is essential and the hot water must be kept in movement to prevent local overheating.

Research is still proceeding on this problem and the Sugar Experiment Stations Board has viewed the matter so seriously that it has approved the expenditure of sufficient money to send one of our pathologists to California University for three months' specialized study into methods of detection of plant viruses. Mr. Steindl will be leaving Australia this month. The problem is not solved by the discovery that heat treatment cures the disease. Such treatment is not easy and it is time consuming. Perhaps in twelve months there may be further light to shed on the problem, but in the meantime delegates to this conference should give a lead in their districts by arranging through Cane Pest and Disease Control Boards for as much hot-water treatment as practicable to be carried out this planting season.

Some Freaks of Sugar Cane*

By J. H. BUZACOTT

Not infrequently Pest Board Supervisors and farmers bring in specimens showing features which could be symptomatic of one of the many diseases of sugar cane. Among the most common are three conditions which are the result either of an interference with the plant's physiological processes or of a disturbance in the genetical make-up of the affected portion. They are not associated with what is usually regarded as a diseased state of the plant. The three referred to are "clustered stool," "bunch top" and "variegation." In view of their interest to Cane Pest and Disease Control Board Supervisors a brief description of these deformities is given here and photographs of affected plants will be circulated.

Clustered Stool.

Small stunted stools with an abnormal number of shoots are sometimes found in the variety P.O.J.2878, and also on occasion in Q.50 and Pindar. Its chief interest lies in the fact that an affected plant bears a strong resemblance to the stools which develop from planting Fiji disease-infected setts, although of course the typical, small galls on the lower surface of the leaves are lacking.

The exact cause of the phenomenon of "clustered stool" is not known although it is believed to be related to the formation of stem galls and adventitious buds which are dealt with under "bunch top."

Bunch Top.

Stem galls are excrescences which

* Paper presented at Annual Conference, Cane Pest and Disease Control Boards, Tully, 1953.

form anywhere along a cane stalk. From these galls adventitious buds often arise, sometimes in large numbers (*see* Fig. 1). When these adventitious buds originate near the growing point of the cane the single shoot which is the normal termination of a cane stalk becomes replaced by a number of small

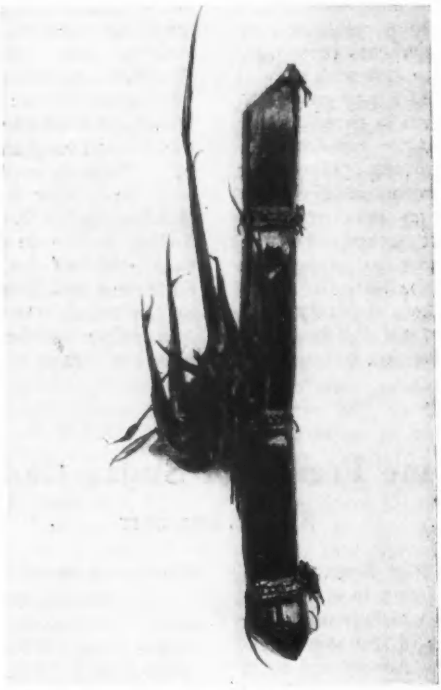


Fig. 6—Stem galls with adventitious buds. Variety P.O.J.2714, a sister cane to P.O.J.2878.

shoots. These multiple top shoots are sometimes quite normal in appearance; at other times they are very much flattened with the leaves reduced in size. Very frequently the terminal bunch top, which is usually called a " witches' broom," is caused by an abortive arrowing. An excellent example of this is shown in Fig. 2.

Although the natural cause of stem galls, bunch top and witches' broom is not known it has been demonstrated in Hawaii that the galls can be caused artificially by injections either of certain insect juices or of growth promoting substances. In spite of this, inoculations using juice from the galls themselves did not result in any growths. This suggests that in nature the malformations are probably brought about by the feeding of insects which may have an effect on the auxins of the plant. In other words, the outgrowths are physiological in character and are not due to the infection of the plant by a virus or other agent.

Variegation or Sectorial Chimera.

Sugar-cane leaves marked with well-defined, longitudinal, white stripes (*see* Fig. 3) often force themselves on the attention of field officers on the alert for disease symptoms, and only slightly less obvious are the stripes found occasionally on the stalks of commercial canes. In some instances both

types of stripes are associated in the one plant, as with certain of the recent New Guinea introductions, but it is common to have the one without the other. Whitish leaf stripes are found with chlorotic streak and leaf-scald diseases, but these can easily be separated from the sectorial chimeras by the lack of sharply defined edges, the irregularity in outline, the presence of secondary developments such as death of the tissue, or a yellow rather than a white general colour.

The variegation in either leaf or stem

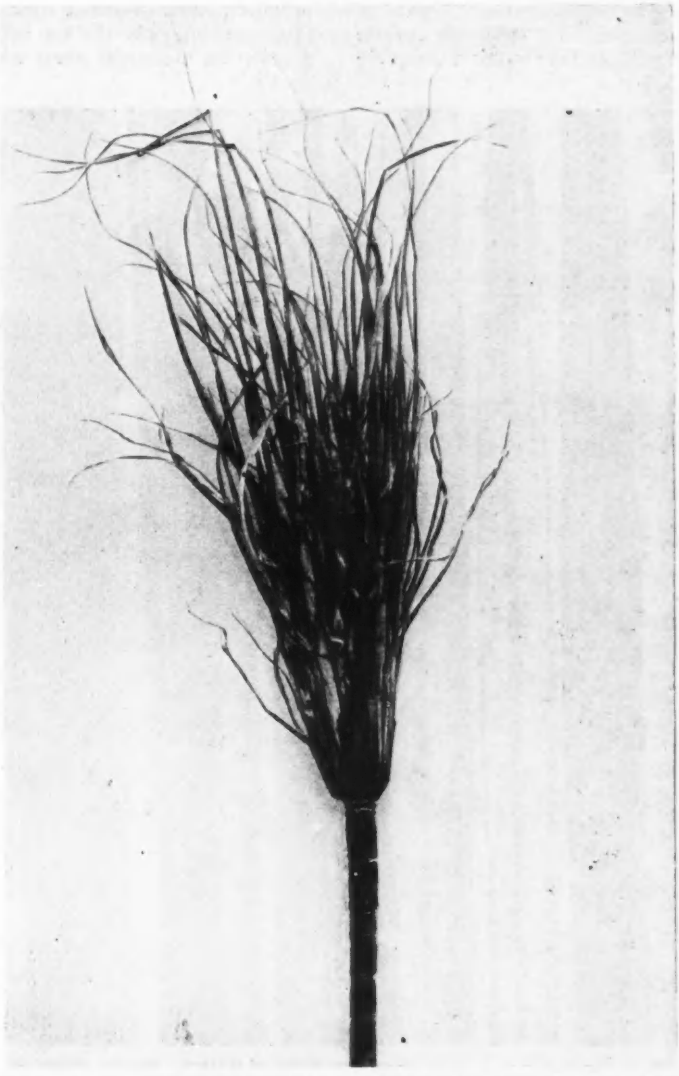


Fig. 7—An excellent example of witches' broom due to abortive arrowing in D.1135.

is due to a mutation or sudden change in the chromosomes in the cells of a bud producing that particular portion of the plant. The same pattern of variegation will often be seen in all the leaves on the one side of the affected stalk and a similar happening occurs on the stem. A bud on a sett taken from an affected stalk will grow exactly according to its position with regard to the variegation. If it subtends a white stripe it will produce either a complete albino or a part albino, *i.e.*, a variegation; if in normal tissue, all shoots from it will be normal.

Neither clustered stool, nor bunch top, nor leaf variegation is sufficiently common to warrant any control action. Planting out from a clustered stool would be impracticable because insufficient cane would be developed to provide plants. From a stick affected by bunch top only the top sett would develop an abnormal plant whilst the

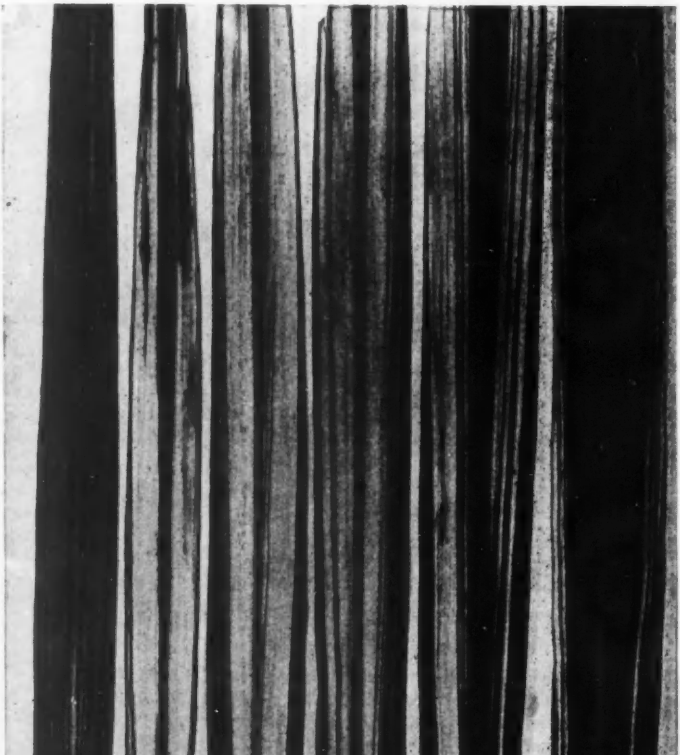


Fig. 8—Variegation or sectorial chimera in leaves of H.Q.426. The leaf stripes are often associated with stripes in the rind of the stem.

general appearance of a stick suffering from witches' broom would cause it to be discarded when cutting plants. It is possible that a farmer, attracted by the striped leaves, might plant out setts from a sectorial chimera. Generally the result of this would be a series of chimeras with less vigour than the original variety. It is wise, therefore, to discourage farmers from planting from affected stools.

Poisoning of Redbills (*Porphyrio melanotus*) in the Moreton Area*

By M. H. WELLS

In normal seasons redbills or coots are responsible for only minor injury to young fields of cane in the Moreton Mill area. Damage is usually confined to a few stools close to the swamps and takes the form of a pecking of the young shoots of either ratoon or plant cane as they appear. Owing to scarcity of natural food in the marsh lands during the 1951-52 drought, hundreds of these birds moved during spring into areas adjoining fields of cane, and the young cane became their main food supply. Not only were the young shoots eaten, but the stubble of freshly cut stools was pecked out, leaving nothing but a group of "egg-cups." Furthermore, harvested stalks were damaged at either end. Previously the standard method of riddance was to use firearms and thereby frighten the pests back to their usual surroundings. However, this method was found to be useless on this occasion when large numbers were present and there was a shortage of food in the swamps. It only resulted in chasing them from one farm to another, or even from place to place on the same farm.

At this stage attempts were made to poison the birds by using orthodox methods. Thallium sulphate-treated wheat was placed along the boundaries of some canefields and adjoining the shelter to which the redbills retreated when frightened. Phosphorus-coated bread was also tried, while a number of growers also used wheat soaked in an arsenical solution. These measures had no appreciable effect, and the destruction of cane adjacent to swamp lands continued.

Explosives were also used in an effort to scare the birds back into the swamps. A series of charges linked to a cable were fired electrically and immediately after the discharge the redbills retreated screeching into the swamp timber. Further charges were fired which sent them still deeper into the swamps. However, the method proved a failure, as within two hours after the explosion swarms of the birds had returned and were feeding normally though a little warily. One or two growers had a little success with dogs, which had been encouraged to chase the redbills.

Finally, it was decided to try feeding the birds poisoned samples of their current major food. This proved a most successful method of control. Details are as follows:—

A well developed stick of sugar cane is cut slantwise at one end and driven into the ground. The stalk is then severed by a slanting cut about three inches above the ground and a hole dug into the exposed flesh with the pointed end of a file. A few crystals of strychnine are introduced into the hole by dipping the wetted end of the file into the poison bottle and then transferring the adhering crystals to the hole. The operation is then repeated along the cane lands adjacent to the birds' natural habitat, fresh sticks of sugar cane being obtained as required.

* Paper presented at Annual Conference, Cane Pest and Disease Control Boards, Tully, 1953.

The efficiency of the method was proved by an eye-witness, who declared that within five minutes of ingesting the poison a bird was on its back quite paralysed and near death. Counts made during the initial baitings showed up to thirty for the first kill on one farm, but thereafter the birds apparently became frightened of the carcases lying about and damage lessened to almost nil. It would appear that the pest was rendered innocuous more by fright than by actual elimination.

This strychnine method proved so successful that it is now the recommended control measure in the Moreton area, but a word of warning must be issued. Strychnine is an extremely dangerous poison and so should always be stored and handled with the respect it deserves. In addition the poisoned carcases are themselves poisonous and should be thoroughly burnt if there is any risk of domestic animals eating them.

Conference of Cane Pest and Disease Control Boards

By R. W. MUNGOMERY

The Fifteenth Conference of Cane Pest and Disease Control Boards was held at the " Sunkist " Hall, Tully, on Wednesday, 18th March, 1953, when a representative gathering of delegates from most of the sugar-growing districts between Mossman and Nambour assembled under the aegis of the Bureau of Sugar Experiment Stations. In all, 39 answered the roll-call and, in addition, eight officers of the Bureau attended in an advisory capacity.

Mr. L. G. Vallance, Assistant Director, apologised for the unavoidable absence of the Director of Sugar Experiment Stations, Mr. N. J. King, and welcomed delegates on behalf of the Chairman of the Sugar Experiment Stations Board, the Hon. H. H. Collins. He then called for nominations for chairman of the day's meeting, and Mr. W. C. Kohn, a Tully delegate, was unanimously elected, and subsequently took charge of the ensuing proceedings.

Mr. Kohn then called on Councillor C. Dickinson, Chairman of the Cardwell Shire Council, who opened the Conference and stressed the importance of these meetings in furthering the well-being of the sugar industry.

The first paper presented was one by Mr. P. Volp, entitled " Further notes on the control of grubs with BHC in the Mulgrave area." In it Mr. Volp showed that locally, frenchi grub infestations were normally to be expected in at least half of the areas usually infested by grubs of the greyback beetle. Therefore, applications of BHC must be made on the basis of achieving complete control of both species. This is accomplished by an application rate of 75 lb. of 20 per cent. BHC dust per acre.

Another interesting paper, " Giant termites damaging young plant cane," which was submitted by Mr. G. Wilson, had particular reference to the Burdekin. It detailed investigational work undertaken with BHC and the newer insecticide Dieldrin in attempts to protect germinating setts and newly established fields of plant cane from attack by these pests. Unfortunately, both materials proved ineffective when dusted on the setts or in close range of them, and it was concluded that the most satisfactory method of ensuring protection is the systematic poisoning of all nearby fence posts and other timber that may harbour nests of these pests.

Keen observation on the part of Mr. M. H. Wells, of Nambour, prompted him to introduce a somewhat novel method of poisoning redbills, which was fully described in a paper dealing with the destruction of these birds. Pieces of mature cane cut off at a sharp angle were loaded with a few grains of

strychnine introduced into the cut ends and, on pecking out the exposed pithy portion, the birds promptly died. It was concluded that the birds quickly became frightened after seeing the carcases of a number of their companions lying around, and damage soon ceased. This explanation was put forward in preference to any suggestion that damage had ceased because of any appreciable reduction in their numbers. In the ensuing discussion, it was elicited that immature corn had also provided an excellent base for baits on the Burdekin, where the same poison is used. Considerable discussion then took place regarding the relative merits of poisoning and paying higher bonus payments for these birds, but the consensus of opinion was that any higher scalp rate would not be favoured by the majority of Boards.

Mr. J. H. Buzacott, in a paper on " Some freaks of sugar cane," described some common deformities which are often mistakenly referred to as a diseased condition of the plant. These included such malformations as clustered stool, bunch top, and leaf variegation. Fortunately, growers usually avoid affected stools when selecting their planting material; hence these abnormal growths are seldom perpetuated.

In presenting notes on " Inspections of sugar cane for chlorotic streak disease," Mr. G. Wilson drew attention to the somewhat evanescent nature of the symptoms associated with the disease, and in support he quoted counts of diseased stools in which the symptoms had disappeared after varying periods. This emphasised the importance of making a number of inspections before recommending any fields as being disease-free, since a single inspection necessarily incurred the risk of symptoms being masked at the time of inspection.

Undoubtedly the most interest in the day's proceedings centered around ratoon stunting disease, on which subject a joint paper by Messrs. D. R. L. Steindl and C. G. Hughes was presented. This was supplemented by a further paper by Mr. Steindl and one by Mr. G. Bates, which dealt with the hot-water treatment of cane setts for the control of this disease. Attention was drawn to the widespread occurrence of ratoon stunting disease throughout all the cane-growing areas of Queensland, and it was stressed that Cane Pest and Disease Control Boards should give a lead in cleaning up this disease by providing clean stocks in each district at strategic points, where these plantings are not likely to be contaminated by other diseases. It was felt that this curative treatment was undoubtedly a matter for each Board rather than one for attention by individual growers.

Various delegates gave details of the construction and capacity of the different heating units which they had operating in their areas, while attention was drawn to the possibility of installing automatic steam regulating valves to assist in operating more efficiently where large-scale production of clean planting material was envisaged. It was stated that some Boards had already treated over one hundred tons of plants during the recent planting season, while others expected to function along similar lines as soon as their coming planting season commenced.

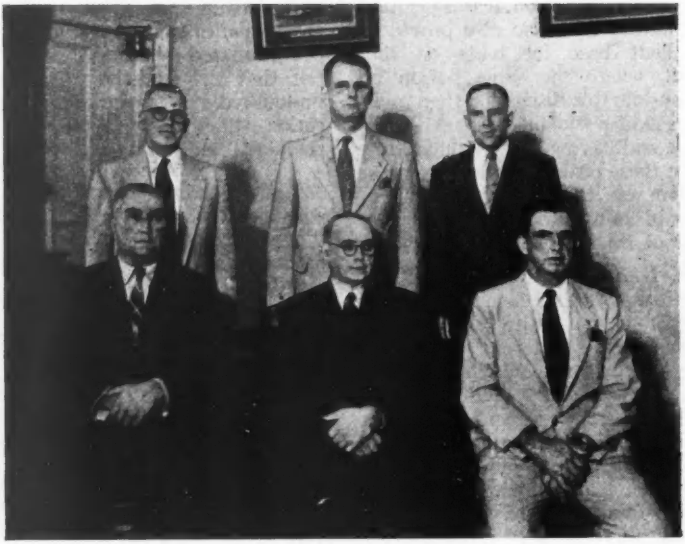
It was decided, on the invitation of the Mackay Board, to hold next year's Conference at Mackay.

In concluding a highly successful Conference, votes of thanks were accorded to the Chairman for presiding; to the Tully Cane Pest and Disease Control Board, and the Tully River District Canegrowers' Executive, who had acted as hosts for the visiting delegates; to Mr. R. W. Mungomery, for his work in organizing the Conference; and to Mesdames E. M. Freney and H. Goldrich, who both had assisted so materially in the excellent local arrangements that had been made.

On the following day, visiting delegates were taken on a tour of the Tully district.

Sugar Experiment Stations Board

When the Act amending the Sugar Experiment Stations Act came into operation in July, 1951, the previous Advisory Board was abolished and the Bureau is now administered by the Sugar Experiment Stations Board. The photograph shows the personnel of the first Board constituted under the new legislation, together with the Director and Secretary of the Bureau.



Front Row:

Centre—The Hon. H. H. Collins, M.L.A., Minister for Agriculture and Stock (Chairman).

Left—Mr. J. W. Inverarity, representative of the manufacturers of cane sugar.

Right—Mr. W. L. Poustie, representative of the growers of sugar cane (Mr. Poustie has since resigned and his place has been taken by Mr. L. G. Scotney).

Back Row:

Centre—Mr. A. F. Bell, Under Secretary for Agriculture and Stock (Deputy Chairman).

Left—Mr. N. J. King, Director, Bureau of Sugar Experiment Stations.

Right—Mr. C. C. Horne, Secretary, Bureau of Sugar Experiment Stations.

1953 Station Field Days

Field days were held at the Northern Sugar Experiment Station, Meringa, the Central Sugar Experiment Station, Mackay, and the Southern Sugar Experiment Station, Bundaberg, on the 12th, 14th and 21st May respectively. At each centre keen interest was taken by large numbers of growers who were conducted over the various experimental plots by Bureau officers acting as guides. Methods of seedling production and testing were explained and farmers had the opportunity of seeing many new cane varieties which were undergoing trials. Long range soil fertility trials and weedicide investigations were also inspected.

A particularly interesting feature was the demonstration of the symptoms revealing the presence of ratoon stunting disease. Agricultural machinery and tractors were displayed by many firms and their local agents. After luncheon those present listened to a series of short addresses. In the course of his talks the Assistant Director stressed the necessity for well planned and active steps in the control of ratoon stunting disease.

Assistant Director's Address.

"During your tour around the Station this morning it may have appeared to some of you that the Bureau's main line of research is concentrated in the breeding, selection and testing of new canes. Of course this is far from being the case, since although the production of new varieties is a major and most important part of our work, it does not overshadow, by any means, the investigations into pest and disease control, soil and fertilizer research, and practically all other aspects of this complex business of sugar cane production. If I were asked to define which was the most important of the Bureau's many functions it would be very hard indeed to give a concise answer. There would be no great virtue, for instance, in producing a new cane of high quality and releasing it to grow in an environment infested with pests and diseases, or trying to establish it on soils which are infertile because of the lack of essential plant food material.

Therefore it is necessary to bear in mind all the many phases which contribute towards efficient production and to neglect none since each is a part of the other. It so happens from time to time that a certain aspect asserts itself and requires an urgency of attention which it must receive or remain a bottleneck hindering the adoption of the successful results of other lines of research. At this present moment such a position has arisen. It is obvious to most of us that the history of the sugar industry is marked with a succession of cane varieties that have come and gone. This is probably more noticeable of recent years when, as a result of advanced knowledge and more experience on the part of the plant breeder, a far greater number of excellent varieties have been made available.

We are now reasonably certain that ratoon stunting disease is one of the major causes of the deterioration which leads to the running out of many once-valuable canes. It is felt that until control of this disease is achieved it will remain one of those previously mentioned bottle necks that will prevent the greatest use being made of the many improvements that have been given to the industry over the last few years—by improvements I refer to such advancements as the use of benzene hexachloride, mercurial dips and high quality varieties.

Fortunately our investigations have shown that hot-water treatment of the sett will cure this disease and it is now a matter of implementing the method on a district-wide basis. Technical details of the control measures have now been given to all Cane Pest and Disease Control Boards in order that these organisations may establish a supply of disease-free canes which will ultimately become available to growers

in their particular area. The programme set the various Boards is a heavy one and the responsibility is considerable. The fact that many of them have already commenced the work with a great deal of vigour and practical commonsense is a source of considerable gratification to us, and we trust that others who apparently have found some difficulty in getting started will ultimately be able to pull their full weight in what is after all their paramount function, *i.e.*, disease control.

be adopted in the release of such new canes as Q.56, Q.57, Q.58, C.P.29/116, etc. These canes have already contracted ratoon stunting disease and it is uppermost in our minds that we would be doing a disservice to the industry if they were allowed to go out into commercial usage in an unhealthy condition, particularly, and this is a most important point, when we have an opportunity to ensure that no stocks of these promising varieties will exist other than those which are disease free. This

Fig. 9—A group at Meringa gathered around a table on which sliced cane stalks exhibiting the symptoms of ratoon stunting disease were displayed.

Growers may rest assured that the Bureau has been most active in the initiation of this work. However, it has not the ramifications necessary to carry out the relatively large-scale operations required in the various mill areas. These must, of necessity, be passed on to the local Cane Pest and Disease Control Board within whose province such extension work lies. I have no hesitation in asking you to take an interest in the functions of your Board and to maintain an active spirit of co-operation in this matter with its field officers.

I feel that it is pertinent at this stage to clear up any confusion that might exist regarding the method that must

opportunity must be seized immediately, since it is unlikely that such a favourable position will arise again once they have assumed commercial proportions. Consequently it is our intention that these new varieties will be withheld from distribution until healthy stocks of cane are built up. It is hoped this year to hot-water treat appreciable quantities which will be planted out and subsequently propagated to obtain sufficient clean material for district wide release. A matter of great concern is to prevent accidental contamination of these established clean sources and in this connection we earnestly seek the co-operation of those growers who

undertake the planting of these plots.

I know that some of you may be perturbed by a delay in the release of a variety to which you were looking forward, but we are confident that any fair-minded grower will recognise that the eradication of disease is in his own interest. Sometimes I think the industry takes it for granted that the cane breeder can produce a suitable new variety at will, to replace one that is running out. However, although this has been apparently possible to date, it may not always be so. Therefore, it is most desirable that any new canes should be protected as completely as it is within our power to do."

Fig. 10—At Mackay as at all Stations displays of new tractors and implements were a source of interest on field day.

Senior Pathologist's Address.

At Mackay and Bundaberg, Mr. C. G. Hughes outlined the history of ratoon stunting disease. He gave details of the investigations which have been carried out and which ultimately led to the discovery of a method of control. During his remarks he pointed out that " the discovery of ratoon stunting disease coincidental with the spread of Q.28 in the southern districts does not mean necessarily that the disease was introduced with that variety on transference from Mackay. To the contrary there is a good deal of evidence that the disease was already present several years before Q.28 came on the scene. Occasionally very poor ratoons had been a normal feature of cane farming in the south (as well as in the north) and the explanations usually offered for the failures were not very satisfying. Farmers had tended to regard this behaviour as more or less normal for the older varieties, but when it occurred in the then popular P.O.J.2878 some interest was aroused. The Bundaberg Sugar Experiment Station itself happened to be the victim on one occasion in 1941 when a trial was planted using setts of P.O.J.2878 from a phosphate-rich and a phosphate-poor soil. It was expected from previous experience that the former setts would give a higher yield than those from the phosphate-poor soil. The crop was severely frosted in the winter of 1941 when only a few months old and for practical purposes the crop harvested in the spring of 1943 was a ratoon some 13-14 months of age. A severe drought, when only 3½ inches of rain fell in six months, hindered early growth, but even so the series from the phosphate-

poor source averaged 43 tons per acre, while that from the phosphate-rich was less than 20. In the light of our present knowledge, it would appear that ratoon stunting disease was already at work.

Although the earlier trials were hindered by adverse conditions—in one case a large trial did not germinate owing to drought, in another excess rain washed it out—our knowledge of the disease was being added to bit by bit and last season two important facts emerged. Firstly, it was discovered that diseased canes, particularly in the variety Q.28, showed characteristic internal symptoms and, secondly, it was found that treatment in hot water would render diseased setts healthy."

The Senior Plant Breeder's Address.

Mr. J. H. Buzacott delivered the following address at Meringa, added interest to which was given by the display of sticks of the many old and new varieties.

"An essential part of any plant breeding institution is a collection of parent varieties and such a collection to be of value requires to be as wide and varied as possible. Quite apart from the question of cross-pollination and breeding the collection can also be valuable for reference purposes and as a basis for taxonomic research.

For many years now the Bureau of Sugar Experiment Stations has maintained its breeding and reference collection at Meringa. As well as original seedlings and those in the various stages of selection which are a necessary part of the seedling raising programme, there are maintained here more than 500 varieties of sugar cane. These include varieties grown at the present time in Queensland, the foremost varieties of most of the canegrowing countries of the world, the 1951 New Guinea collection, a selection of wild canes of several species, and lastly many of the old noble varieties which were grown in Queensland in years gone by.

Of the 41 varieties which appear on the approved variety lists of the 31 mills in Queensland, 39 appear at Meringa, the only ones which are not present being Q.48, a variety of little importance, and P.O.J.2714, now grown only in the Giru district.

Included in the overseas varieties are such canes as P.O.J.2878, P.O.J.2961 and P.O.J.3016, three major Javanese varieties in the days when Java was a leader in world sugar production. From Hawaii we have 32-8560, a major Hawaiian variety for many years, and 37-1933, one of Hawaii's first commercial hybrids containing *robustum* blood. Among a number of varieties from Mauritius is M.134/32, which comprises over 90 per cent. of the Mauritius crop. India, as becomes a country which grows sugar cane over a wide range of climatic conditions, is represented by many varieties. In addition to being important commercial canes in India, many of these are among the most valuable parent canes in Queensland, such as Co.270, Co.281 and Co.290. More modern representatives of this country which have yet to be tried in the commercial field in Queensland are Co.475 and Co.617.

C.P.29-116 is a United States variety, well respected in Southern Queensland. Many other varieties from that country are also represented in our collection. Mostly these have been imported for breeding purposes, since they are rather thinner types than those at present favoured by Queensland growers. Puerto Rico has recently provided two interesting additions to the garden in P.R.902 and P.R.905, whilst from Cuba comes Pepe Cuca, a recent outstanding variety in that country. The British West Indies are well remembered for having in the past provided Queensland with B.147 and B.208. Recent importations from there are B.34104, B.4098, B.41211 and B.41227, all produced at the breeding station at Barbados. The relatively large sugar industry of Taiwan is apt to be overlooked by Australians, but two major varieties from there, F.108 and F.134, ensure that country's representation in the collection.

South Africa has been breeding its own varieties for comparatively few years; however, some success has

already been obtained in that country and representatives of its efforts among which are N.Co.292, N.Co.293, N.Co.310 and several others, are now in our garden. The last mentioned of these bids fair to be a commercially successful cane in South Queensland.

The Argentine has representation in the three Tucuman varieties 3950, 4535, and 4624.

Besides these major overseas commercial varieties some of the most valuable parent canes from these countries are also represented.

Of some considerable interest is the introduction to the Meringa nursery last year of more than 100 varieties of sugar cane collected in New Guinea in 1951. It is expected that these will greatly increase the parent material at our disposal for breeding work as well as providing varieties of considerable botanical interest.

To the plant breeder among the more interesting section of the variety garden is the collection of wild types. These include *spontaneum* types from India, Burma and New Guinea, together with hybrids of Turkmenistan clones of this species; *robustum* types from New Guinea; and representatives of the species *sinense* and *edule*.

Many of the old varieties in the collection are of considerable interest. The varieties, Cheribon, Malabar and Otamite were, for instance, introduced to Queensland prior to 1874, whilst D.1135 was introduced in 1895. Goru and Mahona came from New Guinea with Badila in 1896, and B.147 and B.208 from the West Indies in 1898.

The arrival of the twentieth century saw the introduction of Black Innis and Uba in 1900 and M.1900 Seedling and Petite Senneville in 1901.

Of the early Queensland-bred varieties H.Q.285, H.Q.409 and H.Q.426, bred by the C.S.R. Coy. at Hambledon, and Q.813 and Q.1098, raised by the Queensland Acclimatisation Gardens from seed collected in North Queensland, are represented. These five varieties were among the first local productions and were all produced between the years 1901 and 1905. It is interesting to note that although Badila is easily the most important old variety which still survives in commercial production, B.208, D.1135, H.Q.426 and Mahona are all varieties fifty or more years old which still appear on the list of approved varieties for some mills in Queensland.

The maintenance of a large variety garden is no easy task. Unfavourable habits of some varieties such as poor vigour, lodging or weak ratooning are all sources of difficulty. The very aggressive type of growth of some of the spontaneums has considerable nuisance value and renders them difficult to keep within bounds, whilst most of the wild canes are so hard in the stalk that special arrangements have to be made for the harvesting and disposal of them.

The Meringa variety collection is relatively small compared with that which is maintained by the United States Department of Agriculture or with the world famous collection formerly held at Buitenzorg in Java. It is nevertheless a valuable one and serves an important part in the production of new varieties for the Queensland sugar industry. In order that there should be no risk of losing many of the valuable varieties in the collection it is proposed to duplicate it in Southern Queensland and this new variety garden has already been established."

The Entomologist's Address.

At Meringa, Mr. G. Wilson outlined the work being conducted, and the information available, on pests which affected the germination and establishment of sugar cane.

"Planting is the most expensive operation on the cane farm. Furthermore, the immediate result in germination is of prime importance. A uniformly good stand of stools is the foundation on which the farmer applies all his subsequent labour and expense for three consecutive crops. The farmer who has planted with care, used the proper fertilizer, possibly used the modern mercurial dip as an added safeguard, looks for a good germination,

satisfactory yields and higher profits to reward him for his diligence and financial investment. Hand supplying in a poorly germinated field of cane is a costly job and one which makes a demand on labour when there is little available. The canegrower must be careful that he does not overlook any factor that may upset his plans and deprive him of the good results that he feels he has earned. When major sources of loss such as any serious disease in the cane, pineapple disease in the soil, improper wasteful fertilizing and damage by grubs have been guarded against, it is timely to devote more attention to minor afflictions. There are minor pests which have a bearing on successful germination and the establishment of the young plant. Some of these can be controlled by plant selection. Some occur in the soil and their control may depend on foresight; or their occurrence may be so irregular that it cannot be foreseen and control measures may not have been evolved. The field entomologist's ability to solve a problem is limited by opportunity and the means of control which are available within economic limits. It is of assistance, however, if canegrowers draw the attention of the entomologist at the earliest possible moment to these irregular occurrences of minor pests. This gives the entomologist the opportunity to study them and attempt control by means of some of the weapons made available by modern chemistry or to advise on methods of cultivation that may help.

Germinations can be very seriously affected if the buds have been destroyed in the standing cane by the larvae of the bud moth-borer. The small grey larvae can sometimes be seen crawling rather rapidly on the cane stalk where it is hidden by the leaf sheath. This larva makes a small hole in the bud and destroys the contents. Some varieties are more susceptible than others, H.Q.426 (Clark's Seedling) being notably so. Some stalks of one of our experimental varieties recently examined had more than 50 per cent. of the buds destroyed. The damage is often more frequent near headlands or grassy areas, but may be quite frequent inside well cultivated fields.

Reports indicate that in another cane-growing country the mealy bug has been found to reduce both the germination and later stooling of young plant cane. These can be seen on cane

Fig. 11—Towards the end of the day groups of farmers foregathered to discuss . . . (Field day at Mackay).

stalks, usually on the upper nodes where they are concealed by the leaf sheaths and congregate in the region of the bud and node. They are small immobile saucer-shaped insects, pink, but covered with a loose mealy white coating and frequently attended by black ants which feed on a sugary substance secreted by the bugs. An inspection of the different cane varieties will soon disclose that some are much more disposed to mealy bug accumulation than others. If carried on cane plants they will be found clustering round the bases of the young shoots. There can be little doubt that their feeding on the juice of the cane is detrimental at this young stage. It is the intention of the entomologist to find out to what extent these insects are harmful. In the meantime it is recommended that heavily infested cane be avoided as a source of plants.

There are other types of injury to the stalk that may adversely affect cane germination. Cane badly eaten by rats has been observed to give poor germination, possibly because the damage allowed fungi to invade the cane even before it was placed in the ground. It is hardly necessary in these days to refer again to the undesirability of breeding up beetle borer by using infested cane for plants, nor, incidentally, to the bad practice of leaving heaps of infested cane discarded for this reason in a moist compact heat to act as a breeding ground.

When the cane has been planted dangers in the soil may threaten the farmer's livelihood. Although the major threat of grub damage has been overcome by means of BHC, reports are occasionally received that frenchi grubs in the third stage, which have escaped being destroyed in their younger stages by ploughing before planting, may cause trouble. When ploughing out of cane in early spring was immediately followed by replanting this source of damage was not uncommon, and for that reason replanting without a fallow in areas subject to frenchi attack was discouraged. However, frenchi grubs originating in grass or legume fallow may cause trouble in young plant. The extent to which this occurs cannot be ascertained by us unless growers report the occurrence while it is taking place. A special method of applying BHC at planting time was developed to overcome third-stage frenchi attack. It is of great interest to the entomologist to know to what extent this special method could be applied. In the hands of farmers, the application of BHC is safer and more convenient if made when the cane has emerged. Therefore, an extensive adoption of the method of applying it in the drill is not recommended, but there may be instances in which it could well be used. The details of the method should be carefully ascertained from the field adviser before it is attempted.

Wireworms are another enemy of germinating cane that can be overcome by the proper use of BHC. The small amount required can be mixed with the fertilizer. This control is by now fairly well known to cane growers. Some of the smaller round wireworms that occur in the north are not easily found and the assistance of a field adviser should be sought when in doubt as to whether wireworms may be the cause of damage.

Termites or white ants may cause considerable trouble in germinating cane. The large Giant Termite is found in the Burdekin district and recent experiments to control its ravages by means of moderate doses of BHC and another new insecticide, Dieldrin, applied in the drill, have been unsuccessful. The Giant Termite is not found in the far northern areas, but there are smaller species which can be troublesome and may occur on lands recently cleared of timber for new or increased assignments. If any such occurrence is brought to the notice of the entomologist it will provide an opportunity to study the problem and develop a suitable remedy.

Mole crickets, of which there are two species affecting cane, occur irregularly in badly drained soils. They bore circular holes about three-eights of an inch in diameter through the cane setts and frequently chew partly, or com-

pletely, through the bases of the young shoots. Efficient pipe drainage has been known to rid a field of these insects. Their occurrence is irregular and usually unforeseen, the damage being reported too late for remedial measures to be attempted. It is possible that some of the new insecticides could be successfully used against these.

The Black Beetle and grubs of the Christmas Beetle occasionally attack very young cane in the spring. The extent of the damage from year to year is not such as to warrant the cost of applying any control measures on a wide scale in anticipation of their occurrence. When damage is observed it is inconvenient and usually too late to apply a remedy with results commensurate with the difficulties of application. A tedious method of treating setts with lead arsenate and later jetting the soil with that chemical was developed, but it is unlikely that a canegrower would be happy about applying so slow a control method. Opportunity for developing more suitable controls depends on growers advising the entomologists of their occurrence, thereby providing the opportunity for observation and control experiments."

Manual of Cane-Growing

Cane growers will recall that in 1939 the Bureau of Sugar Experiment Stations published a Queensland Cane Growers Handbook and that a copy was supplied free of charge to every cane grower in the State.

That publication is now out of print and it was decided last year to issue an entirely new volume in which such subjects as insect control, disease eradication, weedicides, varieties, etc., would be brought up to date. The new book, "Manual of Cane-Growing," is now being printed and will be posted free to every cane grower. The entire volume has been rewritten by officers of the Bureau of Sugar Experiment Stations and covers every phase of cane culture from land clearing to crop harvesting.

The Bureau expects to receive the volumes from the printers during June and July, and it is hoped to have them distributed within a few weeks of their receipt.

Technical Correspondence School

We have received information from the Department of Public Instruction that correspondence courses are available in a wide variety of subjects. Of interest to farmers is the "Rural Course," which covers many aspects of agriculture, animal husbandry, farm mechanics, etc. Also available is the "Certificate Course in Agricultural Science," dealing with the science of soils, plant and animal life and including lectures on land and animal management.

For further particulars, those interested should write to the Supervisor, Technical Correspondence School, Box 1389 R, G.P.O., Brisbane.

Some Aspects of Pre-emergence Spraying with 2,4-D*

By G. BATES

Introduction.

The recent development of hormone sprays has inspired many growers to experiment with this pre-emergence type of weed control. Results have varied, some growers being perfectly satisfied with the results while others have had failures. This is to be expected when one considers the wide variety of conditions to be dealt with and the fact that most users have not had experience with these types of sprays.

Causes of Failure.

Most failures can be attributed to:

The land not being absolutely clean when sprayed.

Inadequate mixing of the spray material.

The clogging of nozzles, inefficient pumps, and possibly using insufficient liquid per acre for the type of nozzle being used.

Nozzles incorrectly set so that complete coverage is not obtained.

Spraying under very windy conditions.

Having land clean at time of spraying is absolutely essential, and the sooner spraying is done after cultivation the better the chance of success. Whilst 2,4-D will kill many weeds, members of the grass family are scarcely affected at the low concentrations used. With newly planted cane spraying should preferably be carried out the same day as planting, after shaping the drills with a cotton king or similar implement. Instances have occurred where control was not obtained when spraying was carried out some days after planting unless some form of cultivation had been used in the meantime. Under the tropical conditions prevailing in North Queensland grass seeds commence to germinate quickly, and although 2,4-D will kill many growing weeds, it is effective against grass only as a pre-emergence spray.

The inadequate mixing of 2,4-D has no doubt been responsible for many failures. Complaints have been received that results vary from batch to batch and package to package and this could be caused by variation in the ease of solubility of the spray material. It has been found that while one batch of 2,4-D will dissolve easily another batch is hard to dissolve and in some cases about 20 per cent. of the material is left in the bottom of the mixing bucket. It is of interest to note that this residue has in some instances been soaked in water overnight without dissolving. However, boiling water will dissolve this residue.

It is necessary to watch the nozzles during spraying operations for clogging can cause failure through faulty coverage, but with care in straining the solution and the thorough washing of the spray plant after use, this hazard can be reduced to a minimum. Inefficient pumps may also cause trouble by working at varying pressures, and consequently delivering uneven quantities per acre. Nozzles when set too high will give too much drift and when set too low do not give complete coverage. Likewise spraying during windy weather causes much drift and as a result uneven coverage is obtained.

Practice at the Experiment Station.

Meringa Experiment Station has had encouraging results with 2,4-D, particularly in ratoon crops. The standard practice is to work the ratoons by grubbing and scarifying and, after fertilizer has been applied and the land

* Paper presented at Innisfail Conference, Q.S.S.C.T., March, 1953.

is completely clean and in a reasonably fine condition, then spray with 4 lb. per acre 2,4-D immediately after cultivation. The 2,4-D is dissolved as far as possible in cold water and the residue then dissolved in boiling water. With the tractor in low gear, and using a greenhouse type nozzle with a $\frac{1}{32}$ in. opening at a pressure of 40 lb. p.s.i., 50 gallons of liquid per acre are used. This quantity may seem high for many spray plants deliver only 16 to 20 gallons per acre. To reduce the amount of liquid used a smaller nozzle would have to be fitted or the tractor would have to be operated in a higher gear. This latter alternative does not seem to be desirable because with the slower travel nozzles can be more easily watched for blockages. Excellent results have been obtained to date and as water is easily obtained no attempt has been made to reduce this volume. Many growers have reported that better results have been obtained by using the higher quantities of liquid per acre. It is difficult to check this claim, but it does seem definite that in post-emergence spraying much better results are obtained with a greater volume of water per acre.

With plant cane, the practice at the Experiment Station is to work the cane in a normal way and directly the drills are filled in to apply 2,4-D at 4 lb. per acre. The rainfall is such that there is rarely trouble in keeping very young cane clean and as yet cane has not been sprayed immediately after planting. In the wetter portions of the Cairns district growers feel the need of protection as soon as the cane is planted and there it is the practice to spray immediately. Some growers spray only the line of stools while others give a complete coverage.

In-nut grass areas there is a special problem and the growers' procedure has been to spray immediately the cane is planted with 4 lb. per acre. This does not prevent the nut grass coming through, but does prevent the germination of other weeds and grass. At six to eight weeks there is a mat of nut grass and this is blanket sprayed with 2 lb. per acre 2,4-D, which kills off the growing nut grass and leaves a mulch of dead material on the surface. These remarks apply to wetter areas where the nut grass does not deprive the crop of moisture. On dry blocks where it does seriously compete with cane it may be necessary to carry out the second spraying at an earlier date.

Conclusion.

There is little doubt that growers will have to work out plans to suit their own particular conditions. With variations in soil types, rainfall and temperature, all of which affect the performance of hormone sprays, it is impossible to formulate a single method of use which would be applicable to all farms even in one district. Experience is the best teacher and while there are some disappointments, each year finds more growers who are successful.

A Review of Modern Agricultural Developments and the Record 1952 Crop in the Innisfail and Tully Areas*

By S. O. SKINNER

Introduction.

While the Queensland sugar industry has seen other periods of marked progress, the advancements of the last decade must at least equal those of any other period. It is the writer's intention to summarise the progress and present position of these improvements in the Innisfail and Tully areas.

This area constitutes part of the "wet belt", and with an average annual rainfall ranging from 143 inches in Innisfail to 179 inches in Tully, it differs considerably from the rest of the State. It is of interest to record that great fluctuations in rainfall are experienced, *e.g.*, in the record wet year of 1950 some 311 inches were recorded in Tully.

The major technical advances of particular interest in the area are:

1. The introduction of benzene hexachloride, effecting complete control of the grub of the grey-back cane beetle.
2. The influence of new cane varieties.
3. The introduction of mercurial solutions for the improvement of cane germination.
4. Promise of useful assistance with weed control by chemical means.

Introduction of Benzene Hexachloride.

The application of BHC has now been standard practice in the area for several seasons and its introduction has been, without doubt, the most revolutionary technical change the area has experienced. Too much emphasis cannot be placed on the value of the complete protection to crop and stool, which this insecticide has afforded against devastation by the grub. Also of considerable importance, with the assurance of a crop, is the confidence it has given the grower. No longer need he hesitate to outlay expenditure on fertilizer and other necessary farm practices.

Improved Cane Varieties.

The cropping reliability of Badila, coupled with its good agricultural and milling characteristics, enabled it to withstand challenges from other varieties for upwards of half a century. However, it is now being rapidly replaced by the newer, more vigorous canes. Because of the high yielding capacity of Pindar and the establishment of such useful varieties as Trojan and Q.44, it may be said that the past ten years have witnessed an improvement in varieties that most favourably affects the district's production.

Mercurial Treatment of Cane Setts.

Although cane germinations throughout the district have usually been reasonably satisfactory, present conditions have accentuated a noticeable trend towards poorer "strikes." This is due to such factors as the amount of planting performed during unfavourable periods of the season (a practice into which the grower has been forced), a steady change from good germinating canes such as Badila and H.Q.426 to some of the newer varieties possessing slower and more irregular characteristics, and the apparent build up in many soils of the pineapple disease fungus (*Ceratostomella paradoxa*).

With the stalk method of planting firmly established in several mill areas, prospects for general adoption of the mercurial treatment of setts to improve germination did not appear bright. Any practice which would permit of the

* Paper presented at Innisfail Conference, Q.S.S.C.T., March, 1953.

treatment, suggested a complete revolutionary change from the abovementioned planting method, so peculiar to the wet area. Notwithstanding this, results from preliminary work were so successful, both in effecting a better germination and ensuring a much more rapid and even strike, that numerous growers were quick to adopt the practice. Two methods are used—either the dipping of the setts with the use of the drop planter or the spraying of the sett with a cutter-planter attachment.

Despite early forebodings that the dipping method would reduce the speed of planting, farmers are developing practical systems that are faster and less laborious than the previous popular stalk planting method. The use of circular saws for sett cutting has greatly speeded up the process.

In areas normally prone to irregular or doubtful strikes mercurial treatment is rapidly developing into routine practice.

Chemical Weed Control by 2,4-D.

Because of the frequent rains in the area and need for constant tillage to combat weeds, the possibility of pre-emergence weed control by chemical means was most appealing. During the past two years, the method has been tried extensively by many farmers but the results have varied greatly from success to near or complete failure. From the very commencement of experimental work, it was apparent that the margin between success and failure was somewhat narrow. Some of the reasons that contributed to the numerous disappointments of 1952 were:—

Unsatisfactory condition of field before spraying.

Delay in spraying thus permitting the commencement of grass germination.

Poor machines, or poor spacing of nozzles, resulting in uneven application.

Inadequate volume of liquid and/or inadequate pressure.

Insufficient attention to the output of the machine and to the application of the correct quantity of 2,4-D per acre.

These factors support early warnings that much greater thoroughness is demanded with pre-emergence spraying than with most other farm operations. The method is unlikely to be successful unless the closest attention is given to important details. However, it is felt that weed control by chemical means will find a definite place in the agriculture of the area, since those who have correctly used the method have achieved good results.

To date, from the pre-emergence aspect, particular benefit has been obtained from spraying the line of stools immediately after the harvesting of a field. Again, in new lands where weeds predominate over grass, and cultivation is somewhat difficult, numerous growers have been pleased with the value of 2,4-D as a contact plus pre-emergence spray. The control of nut grass in young cane by contact spraying with 2,4-D when cultivation has been impossible, or has failed, has been satisfactorily achieved by several growers.

The Record 1952 Harvest.

Whilst the foregoing advances indicate a promising future for the districts, it should be emphasised that their effect on the record harvest of 1952 was greatly enhanced by ideal climatic conditions. The weather during the year left little to be desired; regular rainfalls during the spring of 1951 promoted and maintained rapid growth throughout the period, and no severe wet season occurred in early 1952. The absence of the latter was of particular importance and clearly indicated the losses often incurred on the lower lands from poor drainage during heavy wet spells.

The effect of waterlogging is emphasised by a comparison of the 1952 crops in South Johnstone and Tully. These two mill areas differ considerably in several factors—the major portion of the former area possesses fair to good

drainage, whilst the predominating variety is Badila (on the 1951 figures, some 72.6 per cent. of the crop). The Tully area on the other hand comprises much low country which is subject to heavy waterlogging, and the varietal position is different. (On the 1951 figures, Badila accounted for 31 per cent. of the crop—less than half the proportion in South Johnstone, while Trojan with 39.4 per cent. and Q.44 with 16.7 per cent., predominated).

For the last ten years at least, the yield per acre in the South Johnstone area has always exceeded that in the Tully area. However, from figures available at the time of writing, the yield at Tully will increase from 20.5 in 1951 to approximately 31.5 tons per acre in 1952. On the other hand, that at South Johnstone will increase from 24.7 in 1951 to approximately 31 tons per acre in 1952. This difference between the two mill areas and the remarkable gain of 11 tons per acre in the Tully area must, in part, be accepted as an indication of the benefit from the absence of water logging in Tully during 1952, and to a lesser extent the influence of the more vigorous varieties. Thus it is worthy of note that while modern technical advances are of vast importance to the grower, only by continued attention to recognised agricultural factors, such as improved drainage in much of the Innisfail and Tully areas, can full benefits be reaped.

Notes on the Heat Treatment of Cane Plants at the Bundaberg Sugar Experiment Station*

By H. G. KNUST

Since ratoon stunting disease has been found to be widespread in the Bundaberg-Childers district, and since many seedlings in various stages of propagation, as well as standard varieties on the Experiment Station are infected, it has become necessary to obtain healthy stocks of all varieties there. An example of the damage which can be done to a susceptible seedling is illustrated in Fig. 12. The stunted cane in the foreground is a 15 months' old, first ratoon crop from which no cane was harvested because of the severe ratoon stunting disease, while the cane shown in the background, although affected by the disease, yielded 25 tons per acre. Figure 13 indicates the total height of the cane in the foreground of Fig. 12. Both are seedling canes which exhibited good vigour when grown from the first planting from setts, and some idea of the loss of vigour from ratoon stunting disease can be gauged from these photographs. This crop is from the second planting of a seedling from setts and is an example of the rapid deterioration of some seedling canes which show excellent vigour up to the second or third planting from setts. It also indicates that a variety can become 100 per cent. infected during the early stages of its propagation and since the only known means of transmission is mechanical, sterilization of cane knives and cutter planter blades before cutting clean cane is of extreme importance.

Investigational work done by Steindl [1] had shown that a cure for this disease could be effected by treating the plants in water at temperatures ranging from 50° C. for 1½ hours to 54° C. for ¾ hour, and although this work had been done with the variety Q.28 only, it provided a very sound basis for subsequent work. The late spring planting provided an opportunity to investigate further the hot-

---

* Paper presented at Innisfail Conference, Q.S.S.C.T., March, 1953.

water treatment of cane plants on a larger scale, to obtain the reaction of many varieties to this form of treatment, and to establish a nucleus of clean cane for future propagation work.

cane of all the important commercial varieties.

The plant in use at the Experiment Station consists of a 400 gallon ship's tank into the bottom of which is let

Fig. 12—Showing (foreground) cane suffering from severe ratoon stunting disease, and (background) cane of the same age which was less severely affected by the disease.

The Bundaberg and Isis Cane Pest and Disease Control Boards were not slow in realising the necessity for establishing small areas of hot-water treated commercial varieties. With the co-operation of four of the mills in the district, which installed hot water treatment plants, they have made plantings of treated

a $\frac{1}{2}$ in. water pipe arranged in a + pattern and drilled with $\frac{3}{32}$ in. holes at 9 in. intervals from the centre to allow an even distribution of steam for heating purposes. At least 300 gallons of water are used as it is considered that the ratio of the volume of water to that of the cane plants should be not

TABLE I—Counts made eight weeks after planting.

Variety	Buds—planted/germinated		Variety	Buds—planted/germinated	
	at 52° C.	at 53° C.		at 52° C.	at 53° C.
Q.47	1080/139	1080/218	J.58	150/82	150/49
Q.49	360/143	360/105	J.63	150/65	150/66
Q.50	360/111	360/85	J.64	150/43	150/58
Q.55	360/nil	360/nil	J.66	150/109	150/110
C.P.29/116 ..	360/186	360/109	J.68	150/80	150/49
J.8	120/52	120/54	J.69	150/85	150/25
J.24	120/25	120/73	J.70	150/43	150/31
J.28	120/80	120/63	K.6	90/34	90/27
J.32	120/31	120/39	K.37	90/56	90/34
J.33	120/83	120/85	K.85	90/49	90/27
J.34	120/63	120/39	K.98	90/3	90/6
J.38	120/46	120/45	K.159	90/35	90/44
J.42	150/94	150/83	K.162	90/41	90/28

less than 3 : 1. The temperature is easily maintained and ample room provided for the essential regular agitation of the cane during treatment.

Varietal reaction to hot-water treatment varies and many canes germinate poorly when submitted to the higher temperature. Table I shows that treatment at 52° C. for 1½ hours generally produced a slightly better germination than treatment at 53° C. for one hour.

Planting material used for the above was as follows: Q.47, Q.49, Q.50, Q.55 and C.P.29/116, 12 months old plant cane; J. seedlings, 13 months' old first ratoon; K seedlings, 12 months' old first ratoon. In all cases the soft top portion of the stalk was discarded as this provides poor planting material and rots very readily after hot-water treatment.

The time-temperature factor obviously plays an important part in ultimate germination, and some canes which germinated poorly when treated at 53° C. for one hour showed much better response when treated at 50° C. for two hours. Table II shows that some canes have germinated well after treatment at 53° C., while others have germinated poorly but have stood up reasonably well to treatment at 50° C. The class of cane used in this instance was 13 months' old, well-grown plant cane.

Fig. 13—Showing the total height of the stunted cane in Fig. 12.

Stands from cane which gave a germination of 75 per cent. and better were satisfactory and these were not treated at 50° C.

Some investigations were made with hot-air treatment of canes which reacted uncertainly to hot water treatment. Twenty setts of Q.47 were placed in an incubator with the temperature ranging from 51.8 to 53° C. and left there overnight for a total period of 13 hours, during which time the temperature range increased to 52.8° C.–53.8° C.

The plants were then kept in moist bags in the incubator at 29° C. for four days and no evidence of germination of buds or root primordia was apparent. They were then transferred to moist soil and within ten days buds had germinated on every sett and all showed excellent root growth.

Sixty setts of H.18, a seedling which consistently failed with hot-water treatment, were placed in the incubator so that free air circulation would occur, and in the process the thermostat was enclosed in the approximate centre of the cane. The temperature ranged from 51.8–53° C. when the plants were placed in the incubator, but during the eight-hour treatment period the temperature range rose to 53.8–55° C. Germination tests were then made by placing the cane in soil and maintaining soil moisture at the optimum level for germination. Root growth was good on all setts and germination figures are given in Table III.

TABLE II

Variety	Percentage germination		Variety	Percentage germination	
	at 53° C. for 1 hr.	at 50° C. for 2 hr.		at 53° C. for 1 hr.	at 50° C. for 2 hr.
B.37–161 ..	40	53.4	H.37–1933 ..	2.5	92.3
C.P.29–120 ..	72.5	46.6	N.Co.291 ..	30	81.2
C.P.30–24 ..	40	no material available	N.Co.292 ..	40	55.1
			N.Co.293 ..	50	89.6
C.P.36–111 ..	87.5	..	N.Co.334 ..	92.5	..
C.P.43–64 ..	97.5	..	N.Co.339 ..	42.5	45
C.P.44–101 ..	97.5	..	N.Co.349 ..	75	..
C.P.49–50 ..	67.5	75	Mentor ..	50	50
F.134	85	..			

TABLE III

Position in incubator	Setts/buds treated	Setts/buds germinated
Bottom ..	20/65	17/51
Centre ..	20/63	15/51
Top	20/59	18/43

It is considered that, after hot-air treatment, cane should be soaked in a mercurial solution to restore some of the moisture lost during treatment and to control sett-rotting organisms. Adequate soil moisture is also essential.

REFERENCE

[1] **Steindl, D. R. L.:** 1952. Proceedings Cane Pest and Disease Control Boards' Conference, Bundaberg.